Worcester Polytechnic Institute

Physics Department

PH 2501 - Photonics

Course Syllabus – E1 term – Summer 2026

COURSE INSTRUCTOR: Doug Petkie, Department Head and Professor of Physics, Professor of Electrical and Computer Engineering
Pronouns: he/him
Email: dtpetkie@wpi.edu Use "[PH2501]" in the subject line so I know it is related to the course. It elevates its importance!

CATALOG DESCRIPTION: An introduction to the use of optics for transmission and processing of information. The emphasis is on understanding principles underlying practical photonic devices. Topics include lasers, light emitting diodes, optical fiber communications, fiber lasers and fiber amplifiers, planar optical waveguides, light modulators and photodetectors. Recommended background is PH 1110, PH 1120, PH 1130 and PH 1140 (or their equivalents of introductory calculus-based physics courses, along with calculus courses).

STUDENT BACKGROUND: The intended audience is STEM majors at the sophomore level or higher, interested in photonics at a technical level. Prior experience in photonics or optics is not required.

COURSE LOGISTICS: This summer course will be asynchronous, with an optional synchronous online discussion component (recorded and available). The Canvas site will include a detailed schedule listing topics, readings, and assignments. There will be readings and recorded video lectures, with either slides and/or notes to accompany the videos. A tentative schedule in "Course Topics" is listed below; a more detailed one will be provided in Canvas toward the start of the course.

COURSE MEETINGS: M-R | 9:00 AM - 9:50 AM in Zoom. These are optional discussion sessions and will be recorded. If you have conflicts, we can arrange additional meeting times.

COURSE SITE: **Canvas – PH2501-E26-E1 (we will use this for course communication)**

All course materials will be uploaded to the Canvas site, along with a detailed schedule.

TEXTBOOK: ***Quimby, Photonics and Lasers, an Introduction (Wiley, 2006)***. *The textbook is available electronically via the WPI Gordon Library*. You may need to authenticate yourself by going through the library page to access it. Let me know if you have problems accessing the textbook. This textbook was written for this course! The link to the textbook is:
https://onlinelibrary.wiley.com/doi/book/10.1002/0471791598

OVERALL LEARNING OUTCOMES:

- By the end of the course, you will be able to
  - Describe the fundamental properties of light, including its wave-particle duality, polarization, amplitude, reflection, refraction, diffraction, and interference.
  - Predict and describe how like behaves in different media and at interfaces between different materials.
  - Use mathematical models to calculate parameters such as optical power, propagation, coupling between components, and transmission losses.
  - Identify the components and properties of photonics systems, such as light sources, optical fibers, detectors, and other photonic components.
  - Model simple photonic systems to identify and predict specific performance metrics.
  - Represent and communicate physical situations, including simulated and experimental data, in multiple representations, including diagrams, figures, written text, graphs, tables, and equations, verbally and/or in reports and/or presentations (technical communication skills).

- Become familiar with photonic applications in research and industry and identify emerging technologies.
- Develop the ability to solve complex problems that utilize light, photonics devices, and optical systems through critical thinking and analysis.

These outcomes will be developed through the weekly modules.

COURSE TOPICS:

Topical Schedule and Readings

Week(s)	Topics	Chapters	Reading Due	Homework Due
1	Introduction and Overview of Photonics	1, 2	TBA	TBA
2	Optical waveguides, fibers, modes	2, 3	TBA	TBA
3	Attenuation and dispersion in fibers	4, 5	TBA	TBA
4	Fiber coupling, source coupling, diagnostics	6, 7, 12	TBA	TBA
5	Light Sources, Light Detectors, and Photodiodes	13, 14	TBA	TBA

A more detailed schedule will be provided in Canvas and in the Course Discussion Schedule.

COURSE INCLUSIVITY: While this is an online, and primarily asynchronous course, please join me in striving to support an environment that creates a sense of community, safety, trust, and authentic engagement, where we respect each other and the diverse backgrounds and identities we bring to the classroom, WPI, and the world. Participate in discussions (online, synchronous, or asynchronous) and recognize that listening and reflecting are powerful skills to understand different perspectives. Value others' input and be aware of the assumptions you make in any situation.

ASSESSMENT/GRADES: Final grades will be determined based on the following distribution and your performance in each item:

Assessment Activity	Weight
Homework (5 in total)	50%
Reading Reflections	15%
Your problems!	15%
Cumulative Design Project	20%

HOMEWORK: This will be assigned once a week, taking approximately 3-4 hours to complete on average, and be due weekly. Contact me if it takes longer than 4 hours. Submit these in pdf format for grading via Canvas. Please provide detailed solutions, and I will provide solutions to the homework. I am much more interested in the steps and processes you use to solve the problem, rather than the answer. Getting *to* the answer is more important than the answer, and is a transferable skill.

READING REFLECTIONS: Periodically due during the course, submit responses, questions, or summaries to reading assignments.

YOUR PROBLEMS!: Given the diversity of backgrounds in the class, each week, you should generate a problem you are interested in that is based on the chapter's topic (or related to it). State the problem, and then work through the solution in detail. Present it as if you were teaching someone the topic, say a colleague at work. You may pick problems related to your major, something in your background, or just something you are curious about. You may utilize a Generative AI (GAI) system (ChapGPT, Co-Pilot, …), but be completely transparent. You should also upload how you used GAI, along with your solution. Add to the context of the GAI output, and if you have GAI solve the problem, make sure you do too. Completely set up the problem and include diagrams. Present your problem, then attach how you used

GAI as an appendix or supplementary material. Feel free to ask me questions about this! Take this opportunity to be creative and curious, which are very important characteristics!

CUMULATIVE DESIGN PROJECT: I will provide a set of materials and devices for you to characterize the performance of a system that incorporates most course topics. This should integrate most of the topics. If you have an idea for your own cumulative design project, please talk to me to get it approved.

FINAL GRADES: I design the course structure/evaluation so that a typical grading scale can be applied to your overall grade, where 90% or higher is an A, 80% or higher is a B, and 70% or higher is a C. Typically, I do make adjustments to this, where the cutoffs are a little lower in each case.

COURSE ACCOMMODATIONS: Please either speak with me about any course accommodations as well as consult the Office of Accessibility Services. Given the small course enrollment (~10 and not 100+) please meet with me to discuss different options we can agree upon.

COURSE SCHEDULE: There is a separate page (or document) with the course schedule in Canvas. The course schedule and the above policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning. Please check Canvas periodically (daily) for assignments or updates. I should have the next module up when we complete the previous one.

ACADEMIC INTEGRITY: When in doubt, talk to me!!! Individual integrity is vital to the academic environment because education involves the search for and acquisition of knowledge and understanding, which are, in themselves, intangible. Evaluation of each student's level of knowledge and understanding is a vital part of the learning and teaching process and requires tangible measures such as homework, projects, quizzes, lab reports, group work, etc. Any act that interferes with the evaluation process by misrepresenting the relation between the work being evaluated (or the resulting evaluation) and the student's actual state of knowledge is an act of academic dishonesty.

In the learning environment, you are encouraged to collaborate on the homework, although you must submit the homework yourself. *If you are uncertain about when collaboration is allowed and when it is not, just ask!* The world is getting 'muddy' with such things as GAI, and you should use these resources only after you verify they can be used by your instructor. Some allow these, while others consider it an academic integrity violation. For generative AI, please see the following policy.

Please review the general WPI Academic Integrity guide and be informed.
https://www.wpi.edu/about/policies/academic-integrity/student-guide

GENERATIVE AI USAGE POLICY: Generative Artificial Intelligence (GAI) is a rapidly emerging tool impacting all aspects of the world. As we adapt to using it productively, it can still be used inappropriately, which could be considered "plagiarism" or "cheating" and result in an academic integrity violation in courses. In industry, the equivalent of an academic integrity violation could be a lawsuit, and you could be fired for misrepresenting your work (i.e., plagiarism). Worse yet, it could lead to something that causes harm to someone else when not used appropriately. Conversely, it can help us learn quickly to create more value and impact in the world. This is the result we want! The most important thing we can do is be transparent in how we use it and why.

To support these goals, I request the following:

- If you decide to use GAI on an assignment, please disclose how you have used it in the document you submit, or in a supplemental document that you attach and upload with your submission. At a minimum, I want to know: which tool(s) you used and for what, what you perceive as the pros and cons of having used it, how you incorporated generative AI into your process, and whether there remains text/code/brainstorming/verification/... generated by the system in your final

product. There are too many things it can do, so state how it contributed to your product/deliverable/assignment.

- If you use a generative AI system and do not understand its output (e.g., it creates code or written language you do not understand), please do the work independently to understand it. This is important! You can always bring it to me with questions or discuss it together.
- Generative AI usage should be supplemental to your own work. Do: feel free to experiment with it for brainstorming, use it to embellish work you have done, or significantly modify its output (with disclosure!). Don't: give an assignment prompt as input and paste the output as your submission. The latter is an academic integrity violation unless the assignment explicitly states doing this as part of the assignment. Always ask me, or your other professors in other classes, when you are in doubt!!!
- Using generative AI is absolutely not mandatory or expected. If you prefer to avoid these tools, for whatever reason, that's okay! However, they are becoming integrated into all that we do.

This course, as with all professional and academic interactions, operates on the basis of trust and integrity. You can trust me to give feedback on your work, structure policies like this to support your learning as best I can, and give my honest opinion on your usage of GAI in whatever circumstance you choose. I trust you not to pass off generated content as your own and to act with integrity and the intent to further your learning if you choose to experiment with GAI systems.